In the western part of the region the principal Palæozoic strata exposed are volcanic and sedimentary strata, largely limestone, of Carboniferous and Permian ages. More extensive are great accumulations of volcanic and sedimentary strata of Triassic, Jurassic and Lower Cretaceous ages. In the Eastern Cordillera the Palæozoic periods are better represented, as limestone, dolomite, quartzite, shale and other rocks of Ordovician, Silurian, Devonian, Carboniferous and Permian ages are present. These are overlain in places by shale, sandstone, limestone and other rocks ranging in age from Triassic to Upper Cretaceous. The combined thickness of strata of different ages exposed in various parts of the Rocky Mountains, including the Precambrian beds mentioned earlier, is estimated at 68,000 feet. In many parts of the Rocky Mountains, particularly along the eastern border, low-angle faults thrust Precambrian and Palæozoic strata above younger beds.

As already indicated, some evidence now largely obliterated by later events points to early orogenic activities. The principal mountain-building and igneous processes of which good evidences remain began locally in early Mesozoic time, culminated in the Western Cordillera in the Nevadan orogeny in late Jurassic and early Cretaceous time, but was not significant in the Eastern Cordillera until the Laramide orogeny early in the Tertiary. Thus the Western Cordillera were formed much earlier than the Eastern, were largely worn down by erosion by the time the Rockies and other eastern mountains were built, and the western part of the region was uplifted at the time of the Laramide orogeny so that renewed erosion could carve the surface into the present mountains and plateaux. Therefore if one stands on a peak in, say, the Coast or the Selkirk Mountains he is impressed by the uniformity of summit levels representing the ancient, uplifted surface.

The strata in the Western Cordillera are intruded by many bodies of igneous rocks, from small to very large in size. Most are granodiorite or diorite, but many others are granite, gabbro, or other related types; still others are ultrabasic, i.e., composed mainly of iron and magnesium minerals. Most are related to the Nevadan orogeny but some must have been intruded in late Cretaceous or early Tertiary time, and there is incomplete evidence that some are of ages from late Precambrian to Triassic. The intrusions are scattered widely, the largest concentration being the Coast Instrusions which form the greater part of the Coast Mountains. In a general way, this belt of intrusion swings easterly in southern British Columbia and is represented by many large and small bodies in the Kamloops Plateau and the Monashee, Selkirk and Purcell Mountains. Intrusive rocks are rarely exposed in the Eastern Cordillera, probably because the mountains there have not been eroded sufficiently to reveal many.

In the Interior belt much lava was deposited on the plateaux at various times during the Tertiary, mainly in or about Miocene time. The lavas are chiefly of the basaltic variety, and apparently issued from long fissures rather than from volcanoes. Sandstone, shale and volcanic ash were deposited in local freshwater basins in the same belt.

Mountain-building in the western part of the United States formed the Cascade and Coast Ranges there during late Tertiary or early Pleistocene times. These movements, which took place over considerable time and were accompanied by much volcanic activity, are sometimes called the Cascadian orogeny. In the Canadian Cordillera this orogeny was mainly limited to uplifts and some volcanic deposition. Some volcanic activity occurred locally as late as the post-Pleistocene, as evidenced by lava and ash resting on glaciated rocks and glacial debris and by a well-preserved cinder cone in northern British Columbia.

Glaciation was widespread in the Cordillera during the Pleistocene and glaciers persist today in many places, chiefly in the St. Elias and Coast Mountains and the Columbia Ice Field in the Rockies. A large area in Yukon Territory, however, escaped glaciation because the high St. Elias Mountains barred the moisture-laden winds from the Pacific to such an extent that ice did not form in much of the interior, despite the increased coldness of the times. This lack of glaciation was largely responsible for the preservation and discovery of the Klondike gold placers and for other characteristics of mineral deposits in the area.